IRT

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IRT Eurocard

Type DAC-4440

AES / 2Mb (E1) G.703
Network Interface Adapter

Designed and manufactured in Australia

IRT can be found on the Internet at:
http://www.irtelectronics.com

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Revision History

Revision	Date	By	Change Description	Applicable to:
0	13/10/2010	AL	Original Issue.	Firmware version ≥ DAC4440F4V0S4V0
1	02/06/2011	AL	DIP Switch configuration updated to include alarm settings.	Firmware version ≥ DAC4440F5V0S5V0

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Network Interface Adapter

Instruction Book

Table of Contents

This instruction book applies to units fitted with firmware version ≥ DAC4440F5V0S5V0.

Operational Safety:

WARNING

Operation of electronic equipment involves the use of voltages and currents that may be dangerous to human life. Note that under certain conditions dangerous potentials may exist in some circuits when power controls are in the **OFF** position. Maintenance personnel should observe all safety regulations.

Do not make any adjustments inside equipment with power **ON** unless proper precautions are observed. All internal adjustments should only be made by suitably qualified personnel. All operational adjustments are available externally without the need for removing covers or use of extender cards.

IRT Eurocard

Type DAC-4440

AES / 2Mb (E1) G.703
Network Interface Adapter

General Description

DAC-4440 Block Diagram
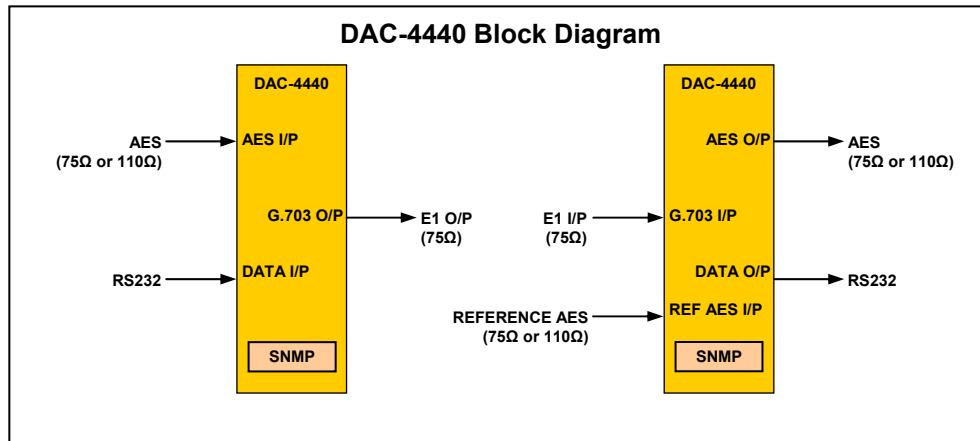
The DAC-4440 forms a transmitter/receiver system, which is designed to allow an AES/EBU digital audio signal to be distributed via a 2Mb G.703 (E1) network.

The DAC-4440 converts an AES/EBU digital audio signal into a non-framed 2 Mb G.703 (E1) compatible signal.

The DAC-4440 combines the 20 bit audio data with either C data, U data or RS232 data into an output stream at 2.048 Mb/s. This stream is then output as a standard G.703 HDB3 encoded 75Ω unframed signal.

The DAC-4440 also converts a G.703 signal, whose content is formatted as per the output of another DAC-4440, to an AES/EBU data stream. The receiver obtains synchronism with the incoming stream and then separates the audio data from the combined C, U or RS232 data.

The DAC-4440 allows a local reference AES/EBU signal to be input for rate synchronization of the output. With no reference signal present, output rate is automatically set to 48 kHz.

The system can handle mono or stereo 20 bit AES/EBU audio at any rate from 25 KHz to 55 kHz, although it is designed for a nominal 48 kHz.

The system also allows either the Channel (C), User (U) or RS232 data to be conveyed.

Front panel LEDs indicate when an AES/EBU signal and RS232 data is present on the transmit side of the DAC-4440, and when a valid 2.048 Mb/s G.703 input signal, and RS232 data, is present and when a valid AES/EBU reference signal is applied to the receive side of the DAC-4440.

Relay outputs are provided on the rear assembly for remote status indication for when a valid AES/EBU or E1 signal is present or invalid.

SNMP (Simple Network Management Protocol) remote monitoring is possible when used in conjunction with an IRT frame fitted with SNMP capability.

Standard features:

- **Conversion of AES/EBU audio to 2Mb/s G.703 for transport via telecom circuits.**
- **Choice of 75Ω unbalanced or 110Ω balanced AES/EBU line connections.**
- **48 kHz 20 bit default sample rate, 25 – 55 kHz rates supported.**
- **Optional external AES/EBU reference input for rates other than 48 kHz.**
- **Allows Channel (C), User (U) or RS232 data to be conveyed.**
- **Bi-direction operation possible with independent transmit and receive functions on the one card.**

Technical Specifications

IRT Eurocard module
Type DAC-4440

**AES Input:**   AES/EBU (75Ω unbalanced or 110Ω balanced).
Input Level   200 mVp-p minimum.
Format   AES3-1992 standard.
Sample Rate   25kHz to 55kHz.
Input Cable Length   >500m   75Ω   (Belden 8281).
                                                  >200   110Ω   (AES digital high quality shielded pair).

Data Input:
Type   RS-232.
Rate   9600 baud.

G.703 Output: 2.048 Mb/s G.703.
Impedance   75Ω unbalanced terminating.
Format   CCITT G.703 compliant.

G.703 Input: 2.048 Mb/s G.703.
Impedance   75Ω unbalanced terminating.
Format   CCITT G.703 compliant.

AES Reference Input: AES/EBU (75Ω unbalanced or 110Ω balanced).
Input Level   200 mVp-p minimum.
Format   AES3-1992 standard.
Sample Rate   25kHz to 55kHz.
Input Cable Length   >500m   75Ω   (Belden 8281).
                                                  >200m   110Ω   (AES digital high quality shielded pair).

AES Output: AES/EBU (75Ω unbalanced or 110Ω balanced).
Format   AES3-1992 standard.

Alarms: MAJOR   Settable for either loss of AES or E1. Open circuit on alarm.
               MINOR   Settable for either loss of AES or E1. Open circuit on alarm.

System Performance (End to End):
Dynamic Range   120 dB   (20Hz to 20kHz, -60dB input).
THD + N   < -88 dB   (20Hz to 20kHz, full scale input).
                                                              (Fin^1 & $Fout^2$ between 25 and 55kHz).
                                                  < -100 dB (1kHz, full scale input).
                                                              (Fin^1 & $Fout^2$ between 34 and 55kHz).
                                                  < -94 dB   (10kHz, full scale input).
                                                              (Fin^1 & $Fout^2$ between 34 and 55kHz).
Output signal rise and fall times   <20 ns.
Frequency Response   ±0.05 dB 20Hz to 20kHz.

           Note: 1. Fin =   sample rate of AES/EBU input to DAC-4440.
                        2. Fout =   sample rate of AES/EBU output from DAC-4440.

Other:
Power requirement per unit   28 Vac CT (14-0-14) or ± 16 Vdc. (<2 VA).
Temperature range   0 - 50° C ambient.
Connectors   Unbalanced   BNC.
              Balanced   Removable screw terminal blocks.
Mechanical   Suitable for mounting in IRT 19" rack chassis with input output and power connections on the rear panel.
Finish: Front panel   Grey background, silk-screened black lettering & red IRT logo.
              Rear assembly   Detachable silk-screened PCB with direct mount connectors to Eurocard and external signals.
Dimensions   30 mm x 3 U x 220 mm IRT Eurocard.
Accessories supplied with module   Rear connector.

Due to our policy of continuing development, these specifications are subject to change without notice.
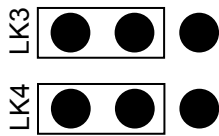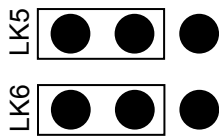
Configuration
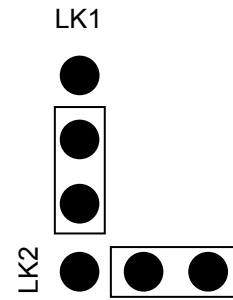
Link Settings:

AES Input - Unbalanced 75 Ω:

LK1

AES Input - Balanced 110 Ω:

LK1
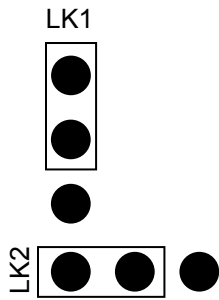
AES Reference Input - Unbalanced 75 Ω:

AES Reference Input - Balanced 110 Ω:

AES Output - Unbalanced 75 Ω:
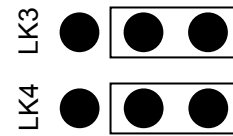
AES Output - Balanced 110 Ω:

DIP Switch Settings:

SW1 — ON ... DIP, switches 1 2 3 4 5 6 7 8
SW2 — ON ... DIP, switches 1 2 3 4 5 6 7 8
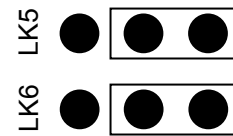
SW1-1 OFF Transmit U data[3] (dependent on SW1-2 setting).
       ON Transmit C data[4] (dependent on SW1-2 setting).

SW1-2 OFF Transmit either C or U data (dependent on SW1-1 setting).
       ON Transmit RS232 data.

SW1-3	SW1-4	SW1-5	Alarm Setting
OFF	OFF	X	No AES alarm & no E1 alarm.
OFF	ON	OFF	No AES alarm & E1 as Major (urgent) alarm.
OFF	ON	ON	No AES alarm & E1 as Minor (non-urgent) alarm.
ON	ON	ON	AES as Major (urgent) alarm & E1 as Minor (non-urgent) alarm.
ON	ON	OFF	AES as Minor (non-urgent) alarm & E1 as Major (urgent) alarm.
ON	OFF	ON	AES as Major (urgent) alarm & no E1 alarm.
ON	OFF	OFF	AES as Minor (non-urgent) alarm & no E1 alarm.

SW1-6 OFF DIP switch control.
       ON SNMP control.

SW1-7 Not used.

SW1-8 OFF Enable major and minor SNMP alarms to the frame Agent (CDM card)[5].
       ON Disable major and minor SNMP alarms to the frame Agent (CDM card)[5].

SW2-1 to **SW2-8** – Not used.

NOTE: 3 U data is User application data.
       4 C data is Channel Status Information.
       5 When using TRAPS via SNMP, depending on how system is set up, in order to avoid double reporting of alarms via the DAC-4440 card itself and the CDM card (SNMP Agent) of the frame, major and minor SNMP alarms that are reported to the CDM card of the frame can be disabled.

Installation

Pre-installation:

Handling:

This equipment may contain or be connected to static sensitive devices and proper static free handling precautions should be observed.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Power:

AC mains supply: Ensure that operating voltage of unit and local supply voltage match and that correct rating fuse is installed for local supply.

DC supply: Ensure that the correct polarity is observed and that DC supply voltage is maintained within the operating range specified.

Earthing:

The earth path is dependent on the type of frame selected. In every case particular care should be taken to ensure that the frame is connected to earth for safety reasons. See frame manual for details.

Signal earth: For safety reasons a connection is made between signal earth and chassis earth. No attempt should be made to break this connection.

Installation in frame or chassis:

See details in separate manual for selected frame type.

Connections:

AES Input:
When operating the DAC-4440 as an AES to E1 network interface adapter, the AES input (connectors marked AES I/O) can either be either a 75 Ω unbalanced terminating or 110 Ω balanced terminating as determined by the links LK1 and LK2 settings as described in the *Configuration* section of this handbook.

The unbalanced 75 Ω AES connection is via a BNC connector and requires good quality 75 Ω coaxial cable, such as Belden 8281. The balanced 110 Ω AES connection is via a 3-pin Phoenix style connector and requires good quality twisted pair audio cable.

AES Output:
When operating the DAC-4440 as an E1 to AES network interface adapter, the AES output (connectors marked AES OUT) can either be either a 75 Ω unbalanced terminating or 110 Ω balanced terminating as determined by the links LK5 and LK6 settings as described in the *Configuration* section of this handbook.

The unbalanced 75 Ω AES connection is via a BNC connector and requires good quality 75 Ω coaxial cable, such as Belden 8281. The balanced 110 Ω AES connection is via a 3-pin Phoenix style connector and requires good quality twisted pair audio cable.

AES Reference Input:
When operating the DAC-4440 as an E1 to AES network interface adapter, the default output rate is automatically set at 48 kHz. If a different AES rate is required it is possible to input a reference AES signal at the desired rate. The AES reference input (connectors marked AES IN) can either be either a 75 Ω unbalanced terminating or 110 Ω balanced terminating as determined by the links LK5 and LK6 settings as described in the *Configuration* section of this handbook.

The unbalanced 75 Ω AES connection is via a BNC connector and requires good quality 75 Ω coaxial cable, such as Belden 8281. The balanced 110 Ω AES connection is via a 3-pin Phoenix style connector and requires good quality twisted pair audio cable.

G.703 (E1) Output:
When operating the DAC-4440 as an AES to E1 network interface adapter, the G.703 (E1) output (connector marked G.703 OUT) is via a 75 Ω unbalanced terminating BNC connector and requires the use of good quality 75 Ω coaxial cable, such as Belden 8281.

G.703 (E1) Input:
When operating the DAC-4440 as an E1 to AES network interface adapter, the G.703 (E1) input (connector marked G.703 IN) is via a 75 Ω unbalanced terminating BNC connector and requires the use of good quality 75 Ω coaxial cable, such as Belden 8281.

> **NOTE:** The DAC-4440 can be used as an AES to E1 network interface adapter (Transmitter) or an E1 to AES network interface adapter (Receiver) in a uni-directional link arrangement, or as both an AES to E1 and E1 to AES network interface adapter at the same time (Transceiver) in a bi-directional link arrangement.

Alarm Outputs:
Major and Minor rear assembly alarm outputs are via a 4-pin phoenix style connector and switch from ground to open circuit on alarm. See *Configuration* section of this manual for setting of alarm conditions.

Alarm connections are as follows:

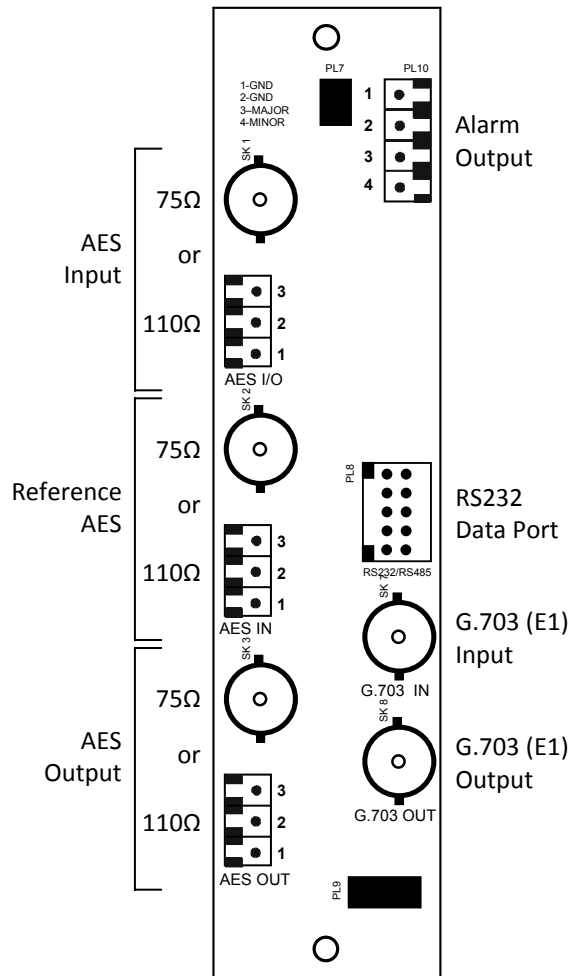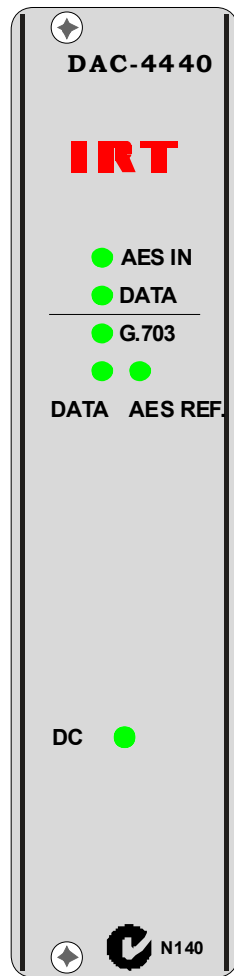| Pin	Signal
1	Ground.
2	Ground.
3	MAJOR.
4	MINOR.
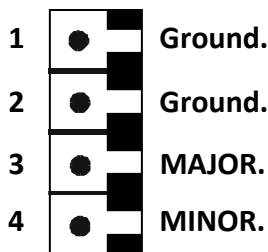
RS-232 Data Port:
The RS-232 data port is via a 10 pin HE14 style of header. Pins 1, 2 and 7 are connected together on the PCB. Pins 9 and 10 are both earthed. Pin 3 is the RS-232 *receive data* (RXD) connection. Pin 5 is the RS-232 *transmit data* (TXD) connection. Data rates may be up to 9600 baud. Note that unless the DAC-4440 is being run in a bi-directional link arrangement data transfer is uni-directional only, i.e. there is no direct data return path.

For connection to a standard RS-232 9 pin D connector, wire as per the diagram below:
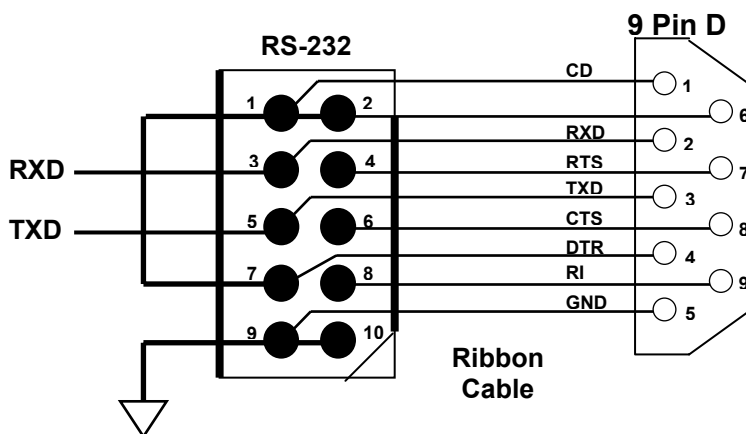
Front & rear panel connector diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show connection order and approximate layout only.

DAC-4440

IRT

● AES IN
● DATA
● G.703
● ●
DATA   AES REF.

DC   ●

N140

AES Input — 75Ω or 110Ω
SK 1
AES I/O   3 2 1

Reference AES — 75Ω or 110Ω
SK 2
AES IN   3 2 1

AES Output — 75Ω or 110Ω
SK 3
AES OUT   3 2 1

1-GND
2-GND
3–MAJOR
4-MINOR

PL7   PL10
Alarm Output   1 2 3 4

PL8
RS232 Data Port
RS232/RS485

SK 4
G.703 (E1) Input
G.703 IN

SK 8
G.703 (E1) Output
G.703 OUT

PL9

SNMP

What Is It?

SNMP stands for Simple Network Management Protocol. It is an application layer protocol for managing IP (Internet Protocol) based systems. SNMP enables system administrators to manage system performance, and to find and solve system problems. SNMP runs over UDP (User Datagram Protocol), which in turn runs over IP.

Three types of SNMP exist: SNMP version 1 (SNMPv1), SNMP version 2 (SNMPv2) and SNMP version 3 (SNMPv3). It is not the intention here to discuss the differences between various versions, only to bring attention to the fact that IRT Electronics modules, fitted with SNMP capability, use SNMPv1.

An SNMP managed network consists of three key components: Network Management Systems (*NMS*), *agents*, and *managed devices*.

An *NMS* is the console through which the network administrator performs network management functions, such as monitoring status (e.g. alarm states) and remote controlling, of a set of managed devices. One or more *NMS*s must exist on any managed network. Generally the *NMS* is a computer running third party SNMP control software. There are a number of third party SNMP software applications currently available on the market.

An *NMS* polls, or communicates with, an *agent*. An *agent* is a network management software module that resides in a *managed device*. An *agent* has local knowledge of management information and translates that information into a form compatible with SNMP. The *agent*, therefore, acts as an interface between the *NMS* and the managed devices. The *NMS* sends a request message, and control commands for the managed devices, to the *agent*, which in turn sends a response message, containing information about the *managed devices*, back to the *NMS*.

A *managed device* contains an SNMP *agent* and resides on a managed network. *Managed devices* collect and store management information and make this information available to *NMS*s using SNMP.

Managed device agent variables are organised in a tree structure known as a Management Information Base (*MIB*). Within the *MIB* are parameters pertaining to the *managed device*. An Object Identifier (OID) number within the *MIB* defines the managed device type. This is a unique number specific to the model of *managed device*. Other information relating to the device is also stored, information such as alarm states, controllable settings, etc. The *MIB* tree is organised in such a way that there will be no two *MIB* files with conflicting placements.

Normally an *NMS* polls an *agent* for information relating to the *MIB* in a managed device to be sent back to the *NMS*. When certain conditions are met within the *MIB*, such as major alarm conditions, for example, the *agent* automatically sends what is known as a *trap* to the *NMS* without any prompting from the *NMS*. This allows automatic notification of a predetermined event.

## SNMP Block Diagram
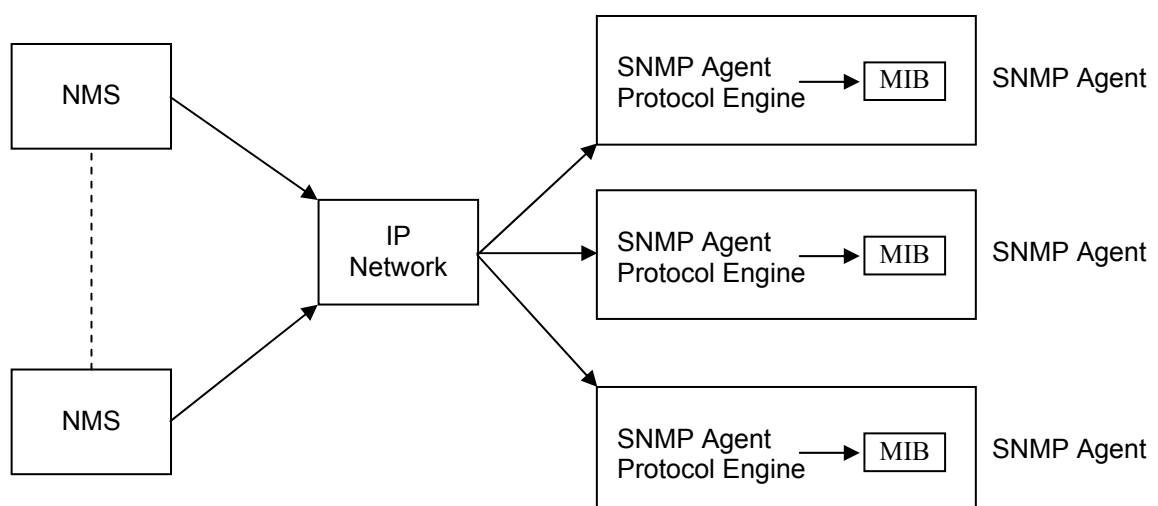
SNMP with IRT Products:

IRT Electronics currently employs SNMPv1 with its SNMP capable frames. The frame acts as an *agent* when fitted with a CDM-xxxx module. This module has its own designated slot next to the power supply so as to not affect the number of modules that the frame will take. Communication between the *NMS*, the frame and its loaded modules are via this CDM-xxxx module. Note that the *NMS* software is third party and not supplied by IRT Electronics.

Ethernet connection for SNMP operation is via an RJ45 connector on the rear of the frame, below the mains inlet. Ethernet rate runs at either 10 baseT or 100 baseT.

Frame parameters, such as Name, Address and Location, are set via an RS232 interface, a D9 connector on the rear of the frame below the mains inlet. A software terminal emulator, such as Tera Term or HyperTerminal, is used for setting and reading the parameters of the frame.

IRT modules that are SNMP compatible need a plug-in SMU-4000 module with a program relevant to the module that it is plugged into. Depending on the module, besides the module identification, parameters such as alarm states, inputs and controls etc. are communicated to the CDM-xxxx *agent* via a data bus on the rear of the frame. Thus the CDM-xxxx collects information on what is loaded within the frame, what positions they occupy, and their current status for communication to the *NMS* when the *NMS* sends a request for information.

In the event of a major alarm from any of the SNMP compatible modules, or power supplies, a *trap* is automatically sent by the CDM-xxxx *agent* to the *NMS* without any prompting by the *NMS*. This alerts the operator to any fault conditions that may exist that need immediate attention.
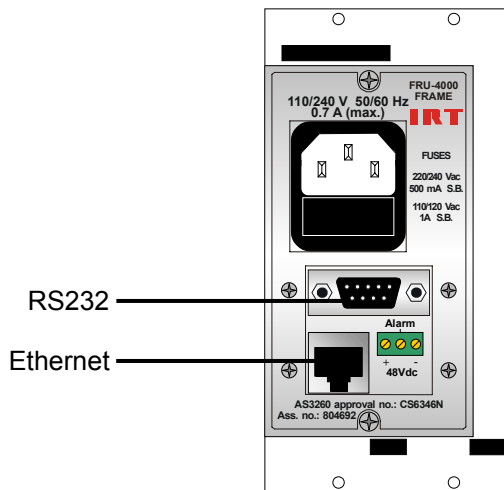
IRT SNMP Connections
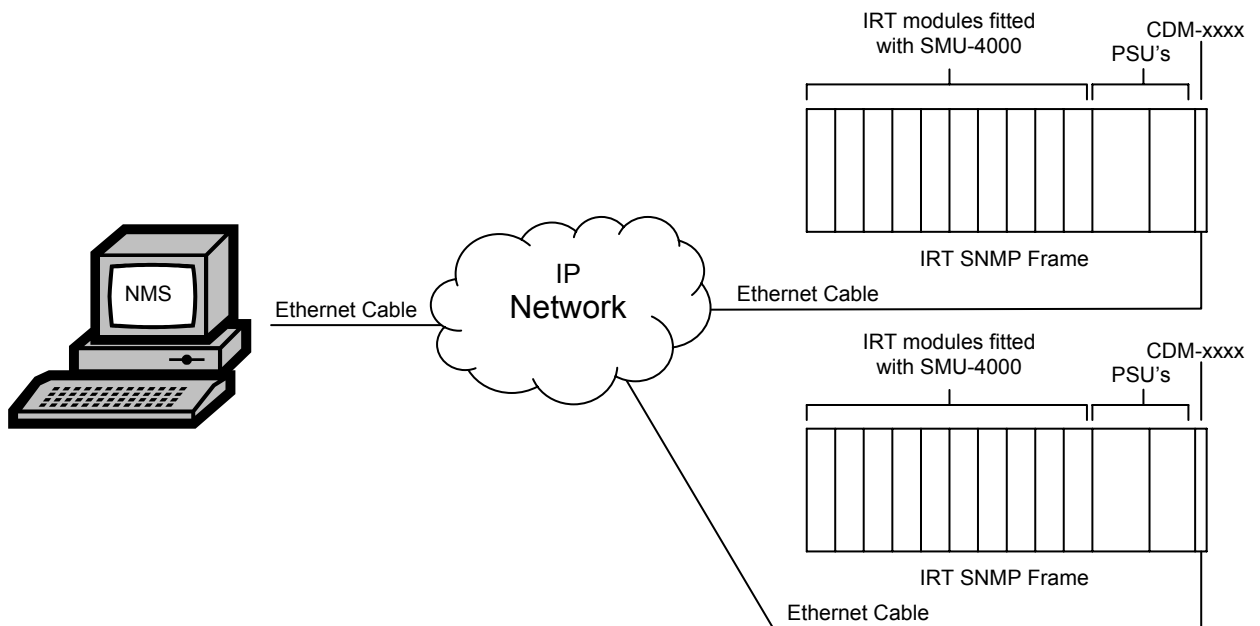
IRT SNMP Setup

DAC-4440 SNMP Functions:

With the DAC-4440 installed in an IRT 4000 series frame with SNMP capability, the DAC-4440 can be configured and interrogated by an SNMP Network Management System (NMS).

The following SNMP functions are capable of being configured and monitored by an NMS:

aesInput
- An indication that the AES input signal is present.
[notPresent (1), present (2)];

aes48K
- An indication if the AES input signal is at 48kHz frame rate.
[notPresent (1), present (2)];

controlSource
- An indication that auxiliary data is controlled by DIP switch or via SNMP.
[dipSwitch (1), remoteSNMP (2)];
NOTE: DIP switch SW1-6 on DAC-4440 controls this setting.

auxSource
- An indication and control of the auxiliary data that is packed in the G.703 (E1).
[userData (1), channelStatus (2), rs232 (3);
NOTE: If DIP switch SW1-6 is OFF, DIP switches SW1-1 and SW1-2 on DAC-4440 controls these settings.

eOne
- An indication that the G.703 (E1) input is present.
[notPresent (1), present (2)];

aesRef
- An indication that the AES reference input signal is present.
[notPresent (1), present (2)];

auxData
- An indication of the auxiliary data that is received from the input G.703 (E1).
[userData (1), channelStatus (2), rs232 (3);

irt4440fpgaVersion
- An indication of the firmware version of the main FPGA in the format x.y where x is the major revision number and y is the minor revision number;

irt4440SoftwareVersion
- An indication of the software version of the NIOS in the format x.z where x is the major revision number and z is the minor revision number;

irt4440reset
- A set with a value of 2 sent to this OID will cause a system reset to occur. When queried returns null.

irt4440presAESTrapEnable
- If enabled, traps will be sent when an AES input is present and when it is not present.
[notEnabled (1), enabled (2)];

irt4440presE1TrapEnable
- If enabled, traps will be sent when a G.703 (E1) input is present and when it is not present.
[notEnabled (1), enabled (2)].

Maintenance & Storage

Maintenance:
No regular maintenance is required.

Care however should be taken to ensure that all connectors are kept clean and free from contamination of any kind. This is especially important in fibre optic equipment where cleanliness of optical connections is critical to performance.

Storage:
If the equipment is not to be used for an extended period, it is recommended the whole unit be placed in a sealed plastic bag to prevent dust contamination. In areas of high humidity a suitably sized bag of silica gel should be included to deter corrosion.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Warranty & Service

Equipment is covered by a limited warranty period of three years from date of first delivery unless contrary conditions apply under a particular contract of supply. For situations when "No **Fault Found"** for repairs, a minimum charge of 1 hour's labour, at IRT's current labour charge rate, will apply, whether the equipment is within the warranty period or not.

Equipment warranty is limited to faults attributable to defects in original design or manufacture. Warranty on components shall be extended by IRT only to the extent obtainable from the component supplier.

Equipment return:
Before arranging service, ensure that the fault is in the unit to be serviced and not in associated equipment. If possible, confirm this by substitution.

Before returning equipment contact should be made with IRT or your local agent to determine whether the equipment can be serviced in the field or should be returned for repair.

The equipment should be properly packed for return observing antistatic procedures.

The following information should accompany the unit to be returned:

1. A fault report should be included indicating the nature of the fault
2. The operating conditions under which the fault initially occurred.
3. Any additional information, which may be of assistance in fault location and remedy.
4. A contact name and telephone and fax numbers.
5. Details of payment method for items not covered by warranty.
6. Full return address.
7. For situations when "No **Fault Found"** for repairs, a minimum charge of 1 hour's labour will apply, whether the equipment is within the warranty period or not. Contact IRT for current hourly rate.

Please note that all freight charges are the responsibility of the customer.

The equipment should be returned **to the agent who originally supplied the equipment** or, where this is not possible, to IRT direct as follows.

Equipment Service
IRT Electronics Pty Ltd
26 Hotham Parade
ARTARMON
N.S.W. 2064
AUSTRALIA

Phone: 61 2 9439 3744   Fax: 61 2 9439 7439
Email: service@irtelectronics.com